REMARKS/ARGUMENTS

This is a Response to the Office Action mailed January 9, 2007, in which a three (3) month Shortened Statutory Period for Response has been set, due to expire April 9, 2007, 2006. Twenty two (22) claims, including three (3) independent claims, were paid for in the application. Claims 1, 5-6 and 22 have been amended to merely comply with proper claim format and antecedent basis. Claims 23-24 have been added. No new matter has been added to the application. The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090. Claims 1-24 are pending.

Objections

Claims 2, 4, 9, 13 and 17 were objected to as being dependent on a rejected base claim, but were indicated by Examiner Nguyen to be allowable if rewritten in independent form. The applicant thanks Examiner Nguyen for this indication of allowable subject matter.

Applicant submits herewith new claim 23 that has some of the features from claim 2. New claim 23 is believed allowable, as discussed later herein.

Given the allowability of claim 1, the applicant believes that claims 1-24 should be allowed as well.

Rejections Under 35 U.S.C. § 103

Claims 1, 5-8, 10-12, 14-16 and 18-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Psaltis et al. U.S. Patent No. 5,949,558 (hereinafter "Psaltis") in view of Trisnadi U.S. Patent No. 5,627,664 (hereinafter "Trisnadi").

The disclosed embodiment of the invention will now be discussed in comparison to the applied reference. Of course, the discussion of the disclosed embodiment, and the discussion of the differences between the disclosed embodiment and the subject matter described in the applied reference, do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner to appreciate important claim distinctions discussed thereafter.

The illustrative and non-limiting embodiments of the present application are directed to a holographic recording apparatus and method for recording information as phase information of light. A signal beam and a reference beam are projected onto a recording medium. The recording medium having an X direction and a Y direction. The X direction is defined as a direction of a line of intersection between an incidence plane and a recording plane of the recording medium. The incidence plane includes optical axes of the signal beam and reference beam. The Y direction is defined as a direction lying normal to the incidence plane and intersecting the line of intersection. The reference beam is modulated with a first phase code to record a first hologram at first position. The reference beam is further modulated with a second phase code, having a pattern different from that of the first phase code, to record a second hologram at a second position shifted in the Y direction to overlap the first hologram. Thus, embodiments of the present application are directed to a holographic recording method that performs both shift multiplexing and phase code multiplexing.

Psaltis teaches recording holograms at different locations only by *shift multiplexing* in the Y direction so as to *partially* overlap the recorded holograms on a recording medium while Trisnadi teaches a holographic recording method for storing multiple holograms, that must be at a same location using different *phase codes* on the recording medium so as to *completely* overlap the recorded holograms on the recording medium.

In contrast, independent claim 1 recites, *inter alia*, "using the reference beam modulated with a first phase code to record a first hologram at a predetermined position…using the reference beam modulated with a second phase code whose pattern is different from that of the first phase code to record at a position shifted in the Y direction a second hologram that partially overlaps the first hologram." (Emphasis added.)

Additionally, both of claims 5 and 22 recite, *inter alia*, "shift multiplexing at least in the Y direction and using phase code multiplexing in combination with the shift multiplexing in the Y direction." (Emphasis added.)

The Office Action contends that one with ordinary skill in the art may be motivated to combine Psaltis and Trisnadi to teach or suggest an advantageous method of combining shift multiplexing with phase code multiplexing, as disclosed in claims 1, 5 and 22.

Applicant strongly disagrees. Such a contention that both references can be combined to achieve the advantageous holographic method of the present application is respectfully rejected herein.

As discussed above, Psaltis teaches shift multiplexing holograms in the Y direction so as to overlap adjacent tracks. More specifically, Psaltis discloses, "overlapping of adjacent tracks may be achieved as illustrated in Fig. 4 by selecting a diffractive element 14 which provides a two-dimensional array of beam sources 16 rather than a line of beam sources disclosed hereinabove." (col. 8, lines 49-51). However, page 2 of the Office Action makes clear that Psaltis does not teach partially overlapping adjacent holograms using shift multiplexing where the adjacent holograms have different phase code patterns, as disclosed in independent claim 1.

The Office Action cites Trisnadi to introduce the method of phase code multiplexing. Figure 2A and 2B of Trisnadi illustrate a phase encoder 28 implementing particular orthogonal phase code patterns. As illustrated in Fig. 2A encoder 28 is divided into four segments, segments 70, 72, 74, 76. Segments 70 and 74 will introduce a phase shift of π radians to the portions of the reference beam 18 that fall upon those segments. Segments 72 and 76 will introduce no phase shift to the light from reference beam 18 that falls upon those segments. A particular page is stored in medium 32 with a reference beam phase encoded, as shown in Fig 2A. (col. 4, line 58 – col. 5, line 8).

Figure 2B of Trisnadi further teaches that another page can be stored at the same stack site using another phase pattern that is orthogonal to that shown in Fig. 2A and that segments 70, 72, 74, 76 of the encoder 28 introduce phase shifts of 0, 0, π, π radians, respectively (col. 5, lines 8-10). Trisnadi, for his recording and retrieval, requires that holograms be stored on top of each other.

Thus, it is apparent that Trisnadi uses different phase codes to record holograms but does not refer to shift multiplexing at these portions at all. Indeed, if he performed shift multiplexing, Trisnadi's recording technique would not work and would render the holograms unrecordable.

Furthermore, column 1, lines 35 – 39 of Trisnadi, teaches "holographic storage capacity is increased by storing multiple holograms at the same location on the recording

medium. This storage of multiple holograms at the same location, referred to as multiplexing can be accomplished in at least two ways: angle encoding and phase encoding."

Trisnadi describes the angle encoding, phase encoding, further orthogonal phase encoding and random phase encoding (also known as first and second types of phase encoding) in detail. Trisnadi further states that it is an object of the invention to provide a method and apparatus for holographic storage with combined orthogonal phase codes and random phase codes which substantially eliminate or reduce disadvantages and problems associated with prior art holographic storage systems (col. 1, line 40 – col. 2, line 35).

Also included in the description of Trisnadi is that "phase encoder 28 is a device that is operable to introduce phase shifts into the wave front of reference beam 18", "The encoder 28 is able to introduce phase shifts at each element of the array. Light from each element, or light element, are thus phase-shifted. These phase shifts make up the phase codes used to multiplex the several pages at one stack site." (col. 3, line 57 – col. 4, line 2).

Thus, as explicitly described in col. 1, lines 35-39 of Trisnadi, Trisnadi teaches a holographic recording method for *storing multiple holograms at the same location* on the recording medium, and Trisnadi does not disclose shift multiplexing for recording holograms so as to *partially overlap*.

As discussed above, Psaltis discloses shift multiplexing but does not make reference to phase code multiplexing. Trisnadi merely discloses a holographic recording method for *storing multiple holograms at the same location* using different phase codes on the recording medium. In other words, Trisnadi teaches a holographic recording method for recording multiple holograms using different phase codes on the recording medium so as to *completely overlap* without referring to shift multiplexing for recording holograms so as to *partially overlap*.

As such, since Psaltis and Trisnadi essentially relate to different holographic recording methods, even one with ordinary skill in the art cannot be motivated to combine Psaltis and Trisnadi. If an attempt were made to modify Psaltis with Trisnadi, there would be no useful output since this would defeat the basic operation of Psaltis. Unless at least one of Psaltis and Trisnadi suggests that it is advantageous to combine shift multiplexing and phase code multiplexing and teaches how that can be modified to accomplish this, since they are not

compatible. Since no such suggestion can be found in any of the cited references, and they are contrary to each other, claims 1, 5 and 22 are believed to be allowable, as are claims 6-8, 10-12, 14-16 and 18-21, which depend therefrom.

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Psaltis in view of Trisnadi and further in view of Wilson et al. U.S. Patent No. 6,697,180 (hereinafter "Wilson").

As discussed above, independent claim 1 is believed to be allowable over Psaltis in view of Trisnadi. The teachings of Wilson are similar to that of Trisnadi. Wilson teaches recording multiple holograms onto a given location of a stationary recording medium while only phase beam orientation is changed relative the recording medium.

The teachings of Wilson do not make reference to shift multiplexing and thus fail to provide a motivation for one with ordinary skill in the art to combine the teachings of Psaltis with either Trisnadi or Wilson.

New Claims 23-24

New claim 23 contains additional features from those of independent claim 1. Claim 23 refers to third phase code and a recording step that is a partial overlap of the three holograms. Certainly, this is not shown in any prior art reference or combines thereof. Consequently, new claim 23 is believed to be allowable as is claim 24, which depends therefrom.

Conclusion

Applicant thanks the Examiner for indicating the allowable subject matter of claims 2, 4, 9, 13 and 17. Overall, the cited references do not singly, or in any motivated combination, teach or suggest the claimed features of the embodiments recited in independent claims 1, 5, 22 and 23, and thus such claims are allowable. Because the remaining claims depend from the allowable independent claims, and also because they include additional limitations, such claims are likewise allowable. If the undersigned attorney has overlooked a relevant teaching in any of the references, the Examiner is requested to point out specifically where such teaching may be found.

In light of the above amendments and remarks, Applicant respectfully submits that all pending claims are allowable. Applicant, therefore, respectfully requests that the Examiner reconsider this application and timely allow all pending claims. Examiner Nguyen is encouraged to contact Mr. Carlson by telephone to discuss the above and any other distinctions between the claims and the applied references, if desired. If the Examiner notes any informalities in the claims, he is encouraged to contact Mr. Carlson by telephone to expediently correct such informalities.

Respectfully submitted,

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